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The Soybean Aphid: Perspectives from Across the Street

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THE SOYBEAN APHID: PERSPECTIVES FROM ACROSS THE MIDWEST

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On June 18, 2001, one of us (B.L.) found soybean aphids, *Aphis glycines*, on V1-stage soybean plants near Decorah in northeastern Iowa. Aphids were common in river-bottom fields and the highest density was 20 aphids per plant. Most of the aphids were clustered on the youngest unexpanded trifoliate leaf. Aphids were not found on hilltop fields even though there were woodlands nearby that might harbor their alternate host, buckthorn. Thus began the second year of our experience with the soybean aphid. This paper will give a brief overview of our understanding of the soybean aphid, potential management guidelines, and insecticide performance data from neighboring states.

Aphid Description

Wingless soybean aphid adults are about 1/16 inch in length, pale yellow or green, and have dark-tipped cornicles (tail pipes) on the back of the abdomen. These aphids feed through piercing-sucking mouthparts and have both wingless and winged forms. The soybean aphid is the only aphid in Iowa that will produce offspring on soybeans. Therefore, any small colony of aphids found on soybeans must be soybean aphids.

Biology and Seasonal Cycle

The seasonal cycle of soybean aphids is complex. The primary host is buckthorn (*Rhamnus*). Eggs are laid on buckthorn in the fall and overwinter there. The nymphs hatch in spring, giving rise to wingless females. These wingless females on buckthorn reproduce without mating and the young develop into winged females that migrate to soybean. These females on soybean produce wingless females that also reproduce without mating and give rise to active young in late May and June. Soybean aphids reproduce faster in cooler environments (72-77°F, with relative humidity below 78 percent, optimum) but when the temperature exceeds 81°F developmental time is lengthened. In China this aphid develops through 15 generations on soybean during the growing season. In late summer the wingless females produce young that develop into both winged females and males. These winged aphids migrated back to buckthorn. There the winged females produce wingless females that mate with the winged males. These mated females subsequently lay eggs, beginning a new seasonal cycle that passes through the winter.

Host Plants

Soybean is the only crop that this insect infests in the Midwest. However, buckthorn seems to be a critical link to success of this pest. Iowa has records of six buckthorn species, including the *Rhamnus davurica*, which is a host reported by the Chinese. However, common buckthorn (*Rhamnus canthartica*), is the most prevalent in northern Iowa and lance-leaved buckthorn (*Rhamnus lanceolata*) in southern Iowa.

Impact on Soybeans

Winged soybean aphids will colonize soybean in stage V2, and maybe even earlier. Aphids feed on young and developing leaves by sucking plant sap, which can cause leaf curling and plant stunting. As the plants grow, aphid populations expand to the middle of the plant and feed on the underside of leaves. Losses of up to 52 percent have been quantified from this injury with early-season infestations in China. Last year, University of Wisconsin entomologists found that 80 to 100 aphids per leaflet reduced soybean yields by approximately 8 bushels per acre. At least in some locations studied, the impact of aphid feeding on soybean yield later in the season is minor, unless soybean mosaic virus has been transmitted by the aphids.

Dense colonies of soybean aphids will cause the growth of sooty molds on the leaves of soybean. Aphids, in general, only digest about 10% of what they consume, the remaining undigested materials are excreted (these excretions are termed "honeydew"). This provides a substrate for sooty mold to develop and cover the upper surfaces of leaves. The affected leaves then suffer decreased photosynthesis, and stunted plant growth may result.

Transmission of Virus

The soybean aphid has had the ability to transmit viruses wherever it occurs. Philippine entomologists found that the soybean aphid was an efficient transmitter of soybean mosaic virus, requiring from 5 to 30 minutes of feeding time to efficiently transmit it. Cooperative studies between Iowa State University (John Hill) and the University of Wisconsin (Craig Grau) just recently showed that this aphid is capable of, and efficient at, the transmission of Iowa soybean mosaic virus strains to soybeans. Soybean mosaic virus is a concern in Iowa. The virus can cause significant yield loss, particularly when plants are also infected with other viruses such as bean pod mottle virus (transmitted by the bean leaf beetle.

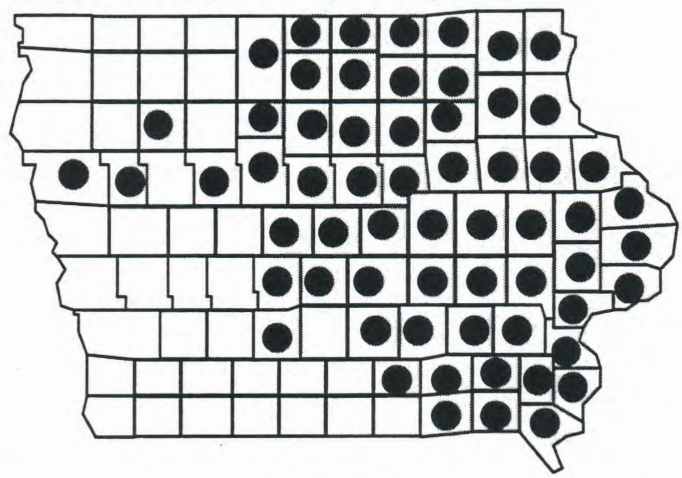
Distribution of Soybean Aphids

The soybean aphid is native to eastern Asia. It has been of economic concern in China, since at least the late 1940's. In North America, it was detected first in Wisconsin during July, 2000. It was discovered in northeastern Iowa the following month. In 2001, the pest was found in Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, New

York, North Dakota, Ohio, Pennsylvania, South Dakota, Virginia, West Virginia, and Wisconsin.

Although it has not been confirmed, we would expect soybean aphids to occur in every county in Iowa. On September 3 soybean aphids were found by one of us (MR) at Correctionville, Woodbury County, in western Iowa. This is the farthest west collection known in Iowa. Aphid densities were very low–less than one aphid per 25 leaflets. The map shows the Iowa counties were soybean aphids were found and reported during 2001.

Known distribution of soybean aphids in 2001



Beneficial Insects

Lady beetle adults and larvae were very abundant in some Iowa soybean fields. These predators probably will be most beneficial in fields with populations that have not reached damaging levels. In fields with noticeable plant stunting and very large populations, the lady beetles probably cannot reduce the aphid population quickly enough to prevent economic damage.

Scouting and Economic Thresholds

Scouting methods for the soybean aphid in Iowa have not been investigated. Therefore, our recommendations could have flaws. However, scouting must be conducted to determine aphid presence and abundance. In pest management, scouting for pest presence and abundance is of little use without having appropriate decision guidelines. Such guidelines are usually given as economic thresholds. The following thresholds are based on our very limited experience and research from China.

Early Season. Tentatively, we suggest scouting five locations per 20 acres, beginning at stage V2. At each site, five plants can be picked then leaves turned over and searched for aphids. Observations should be made weekly until flowering. If aphids are present, estimates of aphid numbers per plant should be attempted.

Economic thresholds have been developed by Chinese entomologists from field plots infested with soybean aphids at the two-leaf stage (V2). Aphids were allowed to feed and reproduce, all plots were sprayed at flowering to eliminate late-season infestations, and yields were taken. To develop a tentative economic threshold for Iowa soybean, Pedigo et al. (2000) used the Chinese data to fit a statistical model to determine the number of aphids per plant at the V2 stage required to produce a later damaging population for a 5 to 6 percent yield loss. With a production of 40 to 50 bushels per acre, it was suggested that this percentage would offset one insecticide application. The model predicts that 4 aphids per plant would produce a population to cause an economic loss. This density would be the economic threshold and the aphids should average this density across the field. In other words, if action were taken against four aphids per plant at stage V2, we would not expect the aphid population to grow to a density capable of causing economic loss in yield. It is likely that insecticide applications could be made within 2 or 3 weeks of the assessment and not result in significant yield loss.

Caution needs to be applied to this recommendation, however. First and foremost, it is based on data from Chinese soybean research. Iowa soybeans may not respond similarly. Second, the aphid population may not have the same growth potential in Iowa as it does in China, producing error in the threshold estimate. Furthermore, the pest may transmit soybean mosaic virus in Iowa, probably resulting in much lower thresholds and different management strategies for preventing loss. Therefore, this economic threshold is a tentative estimate, one that needs to be validated with thorough research.

Mid Season. A major concern is estimating aphid population size and determining an economic threshold or treatment level. Because this is a new pest to the Midwest, no economic threshold, based on local research, addresses this problem. The best that can be done is to develop a nominal threshold, which is a threshold based on the subjective determinations of a person's experience. Before applying an insecticide during July or early August, we suggest that three criteria in the field should be met:

1. aphid populations are heavy and cover the upper trifoliate leaf on a majority of plants,
2. lower leaves are covered with honeydew and turning black from sooty mold, and
3. infested plants appear stunted.

If plants also are under stress from dry soil conditions, feeding effects of the aphids could worsen.

Management Decisions

Management activities for most soybean insect pests consist of scouting, use of thresholds, insecticide applications when necessary, and prevention through cultural activities.

The big question is what to do with fields that have low or moderate-sized populations of aphids? There are no clear answers because of the lack of research on this pest in the United States. There are no mid- or late-season economic thresholds. Heavy rains and beneficial insects may reduce large populations slightly, but insecticides may be the only option in achieving a substantial reduction if the population reaches the nominal threshold.

If an insecticide is sprayed, an unsprayed test strip should be left in the field to compare and evaluate against the sprayed sections. The unsprayed test strip is needed to effectively compare the real value of the insecticide treatment and determine its performance. Also, not all insecticides provide equal levels of control. Ted Radcliffe, University of Minnesota entomologist, reports that the soybean aphid appears to rebound from some insecticides. Presumably these increased aphid numbers resulted from the suppression of beneficial predators.

Several insecticides are labeled for soybean aphid (or Chinese aphid on some labels). These include Furadan 4F (1/2 pint, 21-day preharvest interval), Lorsban 4E (1-2 pints, 28-day preharvest interval), Penncap-M (1-3 pints, 20-day preharvest interval), and Warrior T (1.92-3.2 ounces, 45-day preharvest interval).

Until we learn more about the impact of natural enemies, soybean resistance, planting dates, rowing spacing, etc., we will have to rely on insecticides to manage this insect. Insecticide data are presented from several states along with discussions about the details of the experiments and interpretation of the data.

Minnesota Insecticide Trial

David Ragsdale, Ken Ostlie, and Erin Hodgson, Department of Entomology, University of Minnesota, initiated an insecticide evaluation. Here is their summary: "Plants were in the R2 stage and were planted on the 10th of June (late planting) in 30 inch rows at the Rosemount Agricultural Research and Outreach Center, Rosemount, Minnesota. Plots were four rows, 25 feet long with three replications. Treatments were applied late afternoon on 2 August 2001 under calm, sunny conditions. Fulfill was applied the following morning because a non-ionic surfactant recommended for use with this product was not available on 2 August. Plots were sprayed with a tractor mounted CO_2 powered sprayer using flat fan nozzles (TeeJet 11003) spaced every 15" and adjusted so that 100% overlap occurred six inches below the canopy. Spray volume was 30 gal/acre using 42 psi. Pre-treatment aphid counts averaged ca. 200 per plant. Aphids were mostly found in the top 3 leaflets of the plant (61%). Plots were evaluated on 6 August 2001, 4 days after treatment (3 DAT for Fulfill) by counting the total number of aphids on each of ten plants per plot segregating counts into aphids in the top three nodes and the remaining nodes (average of 10 nodes per plant). Data were analyzed using SAS with data transformed to normalize mean and variance. Data reported are untransformed and represent the average number of aphids per plant. All products were tested at the maximum-labeled rate. Experimental compounds are indicated with an asterisk. Pretreatment aphid counts on 2 August averaged 162.6 per plant. Aphids in the control increased 2.4 fold four days following treatment.

"Nearly all registered products tested gave satisfactory control of the soybean aphid (Table 1). Two compounds, Pounce and Dimethoate, significantly underperformed other products and provided only 85 to near 90% control of the soybean aphid. In general, 95% control or above is needed to prevent resurgence of the aphid population following treatment. As with all aphid control, better results are achieved with high pressure and high volume. Here we used 42 psi and 30 gallons of spray solution per acre. An added advantage of our plots was the lack of a closed soybean canopy that allowed for good penetration of insecticide into the lower canopy. All products gave equivalent control of soybean aphids whether in the top or lower canopy (data not shown).

"We tested all products at the highest labeled rate. It is our opinion that those products that gave near 100% control could be used at the lowest labeled rate and still achieve satisfactory control (>95%). The key to good aphid control is less dependent upon rate than on using adequate spray volume (at least 20 gallons per acre) and high pressure (40-80 psi).

Table 1. Mean number of aphids per plant, four days following treatment. University of Minnesota, 2001.

Treatment / Formulation	Rate (ounces of product per acre)	Mean Aphids per Plant	Mean Separation [1]	Percent Control
Untreated control	---	393.2	A----	---
Dimethoate 4 EC	16 (1 pint)	58.2	-B--	85.1
Pounce 3.2 EC	8.0 (1/2 pint)	40.1	-B--	89.8
Fulfill *2 50 WG	2.75	13.3	-BC-	96.6
Asana 0.66 EC	9.6	3.7	--CD	99.1
Warrior T 1EC	3.2	2.0	----D	99.5
Provado * 1.6F	3.75	1.6	----D	99.6
Actara * 25 WG	3.0	1.2	----D	99.7
Leverage * 2.7 L	3.75	1.1	----D	99.7
Furadan 4F	8.0 (1/2 pint)	0.03	----D	99.9
Penncap-M 2FM	48 (3 pints)	0.03	----D	99.9
Lorsban 4EC	32 (2 pints)	0.00	----D	100

[1] Means followed by the same letter are not significantly different using the Ryan-Einot-Gabriel-Welsch Multiple Range Test.

[2] Fulfill was applied on 3 August so counts represent 3 days after treatment

Minnesota Insecticide Strip Trials

Ken Ostlie, entomologist at University of Minnesota provides the following information: "Soybean aphid appeared in almost all soybean producing areas of Minnesota. In response, several growers and their agronomic advisors conducted on-farm strip trials to evaluate the benefits of insecticide application on aphid populations and soybean yields. Agronomists, ag chemical dealers, district sales managers, and seed dealers have generously agreed to share their results with us.

"These data are intended to provide a preliminary indication of the impact of soybean aphid on soybean production. However, because information from aphid-free checks is not available, the true impact of soybean aphid is likely to be greater than what we have presented here. This information should not be used to evaluate the efficacy of insecticides. Because of limited knowledge about soybean aphid, growers, crop advisors, and university researchers were forced to make 'seat-of-the-pants' decisions about whether to spray. In some cases, these decisions may have come too early or too late. Table 2 provides simple comparisons of treated and untreated strips of soybeans. Unless noted otherwise, treated strips received one insecticide application.

Table 2. Soybean aphid reduces yields: harvest results from insecticide strip trials, 2001. Ken Ostlie (Editor), University of Minnesota, St. Paul, MN.

Trial	Planting Date	Insecticide	Application Date	Yield-Treated (bu/A)	Yield-Check (bu/A)	Yield Difference (bu/A)
19	5/20	Warrior T	8/20	43.1	46.0	-2.9
7	5/13	Dimethoate	7/25	42.9	45.4	-2.6
5	5/16	Lorsban	8/6	57.5	58.4	-0.9
1	5/15	Lorsban	8/11	50.9	50.7	0.2
9	6/10	Warrior	7/24	37.2	34.7	2.5
20	?	Warrior T	8/3	51.2	48.6	2.6
13	5/16	Lorsban 4E	8/8	52.0	47.9	4.1
8	5/18	Warrior	7/27	43.7	39.5	4.3
16	6/8	Warrior T	8/14	50.9	46.0	4.9
2	5/15	Warrior	8/7	45.6	40.5	5.1
11	5/19	Warrior	7/12	54.4	48.5	5.9
22	5/19	Warrior T	8/6	51.7	45.3	6.4
14	6/30	Dimethoate	8/8	33.0	26.5	6.5
12	5/14	Warrior T	8/2	52.1	45.5	6.6
10	5/18	Lorsban	7/27	50.6	42.6	8.0
18	5/30	Warrior T	8/2	46.6	38.2	8.4
23	5/11	Warrior T	8/3	57.3	48.6	8.7
21	5/19	Warrior T	8/6	41.3	32.3	9.0
3	5/16	Lorsban	7/26	27.1	14.6	12.5
6	5/14	Lorsban	7/27	39.7	27.0	12.6
15	5/29	Warrior T	7/27	36.5	22.7	13.8
4	5/10	Baythroid	7/30	47.1	31.0	16.1
17	?	Warrior T	8/2	56.2	39.7	16.5

Illinois Insecticide Trial

John Shaw, Kevin Steffey, and Michael Gray, entomologists at University of Illinois set up a trial in 2000. "Densities of aphids were relatively high before treatments were applied and increased in the untreated control plots by 3 days after treatment (DAT). However, aphid densities 'crashed' in the untreated control plots 10 DAT. Therefore, determination of residual efficacy of all insecticides tested was tenuous. Nevertheless, several registered insecticides and some experimental products reduced densities of aphids by more than 90% on both 3 and 10 DAT.'

"Before the application of insecticides, all plots were sampled to determine the densities of aphids in each of the designated plot areas. Densities of aphids among plot areas before treatments were applied were not significantly different (Table 3). The average number of aphids in the untreated control plots was 53.9 aphids per leaflet. Three days after the treatments were applied, aphid densities in the untreated control plots had increased to an average of 144.9 aphids per leaflet. However, aphid densities 'crashed' (effects of natural enemies dispersal) to an average of 8.6 aphids per leaflet in the untreated control plots 10 DTA.

Table 3. Soybean aphid (*Aphis glycine*) insecticide efficacy trial, Carroll County, Illinois, University of Illinois, 2000.

Treatment	Rate[1]	% Reduction in aphid populations	
		0-3 DAT	0-10 DAT
Penncap-M	0.625	98.92	98.55
Lorsban 4E	0.5	98.75	99.10
Warrior T	0.025	93.39	99.71
Warrior T	0.015	69.95	97.96
Provado	0.025	81.26	94.77
Provado	0.047	57.07	90.21
Baythroid 2E	0.025	47.76	79.54
Baythroid 2E	0.044	78.78	85.39
Leverage	0.0633	98.15	98.32
Dimethoate	0.25	98.36	99.62
EXP 61824A	0.05	98.59	99.94
Actara	0.023	96.95	97.53
Fulfill + nonionic surfactant	0.086 0.25v/v	99.17	99.64
Safer Soap	2.0	---	75.98
Warrior T	0.02	53.12	89.03
Pounce 3.2 EC	0.1	67.18	46.29
Asana XL	0.03	28.96	84.96
Lannate SP	0.45	97.35	96.49
Control		-494.83	57.99

[1] Rates are specified as lb(AI)/acre.

"Densities of aphids in all insecticide-treated plots were significantly lower than densities of aphids in the untreated control plots 3 DAT (Table 3). No significant differences in densities of aphids occurred among the insecticide-treated plots 3 DAT. By 10 DAT, because aphid densities had 'crashed,' there were no significant differences in densities of aphids among all plot areas.

"Table 3 shows the percentage reductions in numbers of aphids from pretreatment levels to levels on both 3 and 10 DAT, based upon average numbers in the plots before treatments were applied and average numbers in the same plots 3 and 10 DAT. Eight treatments (Penncap-M, Lorsban 4E, Leverage, Dimethoate, EXP 61824A, Actara, Fulfill + nonionic surfactant, and Lannate SP) reduced numbers of aphids by 95% or more by 3 DAT. Warrior T applied at 0.025 lb (AI)/acre reduced the number of aphids by 93.4% by 3 DAT. Safer Soap had no effect on the density of aphids by 3 DAT.

"By 10 DAT, numbers of aphids had been reduced by at least 90% in 11 plots treated with insecticides (Table 8.2): Penncap-M, Lorsban 4E, Warrior T at 0.025 lb (AI)/acre, Warrior T at 0.015 lb (AI)/acre, Provado at 0.025 lb (AI)/acre, Leverage, Dimethoate, EXP 61824A, Actara, Fulfill + ionic surfactant, and Lannate SP. Five treatments reduced numbers of aphids by at least 80% by 10 DAT: Provado at 0.047 lb (AI)/acre, Baythroid 2E at 0.025 and 0.044 lb (AI)/acre, Warrior T at 0.02 lb (AI)/acre, and Asana XL. All but one insecticide, Pounce 3.2EC, reduced numbers of aphids by at least 75% by 10 DAT.

"Several registered insecticides and some experimental products show promise for controlling soybean aphids if their densities reach economic levels in 2001. However, because aphid densities 'crashed' in the untreated control plots in 2000, determination of the residual efficacy of the insecticides tested in the trial was tenuous.

Wisconsin Insecticide Trial

John Wedberg, entomologist at University of Wisconsin-Madison provides the following information on a soybean aphid trial in his state. "An insecticide screening trial was started on 26 July. Soybeans were R1 stage and planted in 30 inch rows during early June. Aphids were counted 4 days post spray on 30 July. The data are preliminary and have not been statistically analyzed.

Wedberg states, "as any of you who have scouted soybean aphid are aware, counting aphids is laborious. We have been experimenting with a rating system in the Midwest this year, and (we) used it to sample the spray plots. These are whole-plant scans and there are 7 categories: 0 aphids, 1-10, 11-25, 26-50, 51-100, 101-200, and 200+ aphids/plant. We take sample 20 plants in each plot, and samplers quickly scan upper and lower surfaces of leaves, stems, petioles and pods. In the check plots most of the plants ended up in the 101- 200 and 200+ categories. I used a "relative effectiveness" rating system to give a quick idea of the relative performance of the insecticides. In this system 1=0 aphids/plant, 2=1-10 aphids, 3=11-25 aphids, 4=26-50 aphids, 5=51-100 aphids, 6=100-200 aphids, and 7=200+ aphids/ plant. I multiplied the number of plants that fell into a particular category by the rating for that category (i.e. if you had all 20 plants with 200+ aphids/ plant the score would be 7 X 20=140/20 plants=an average effectiveness rating of 7 for that plot (hopefully, this would be the untreated check in this case). This is similar to the system we use for root ratings in corn rootworm research. Remember, these are preliminary data that we have yet to analyze; I offer it here only because people have been asking for the results. However, based on these data and numerous performance complaints from people around the state. I am suggesting that dimethoate not be used; there were data from last year to suggest that is was as good as anything else available. It has not been acceptable in most cases this year.

"In table 4, plants in the untreated check averaged over 100 aphids per plant (most on the new trifoliolate leaves), and the lowest populations found in the treated plots had from 0-10 aphids per plant 4 days after spraying.

Table 4. Soybean aphid control – preliminary results, relative effectiveness rating – 4 days post-spray, University of Wisconsin, 2001.

Product	Pounds Active/Acre	Average Rating
Lorsban 4E[1]	1.00	1.52
Lorsban 4 E[1]	0.50	1.98
Warrior T[2]	0.030	1.98
Penncap M 2FM[2]	0.50	2.03
Furadan 4F[2]	0.125	2.25
Furadan 4F[2]	0.25	2.75
Dimethoate[1] 4E	0.50	3.01
Penncap M 2FM[2]	0.25	3.21
Asana XL[1]	0.030	3.36
Asana XL[1]	0.040	3.41
Dimethoate[1] 4E	0.25	3.41
Untreated	---	5.15

[1] Labeled for use on soybean, but soybean aphid is not listed on the label.
[2] Labeled for use on soybean and for soybean aphid control.

Iowa Insecticide Strip Trials

One of us (B.L.) conducted insecticide strip trials near Decorah in 2001. Insecticides were sprayed on July 12 and July 26. Treatments consisted of dimethoate, Pounce, Warrior and two untreated checks. Plots were sprayed on July 12 or July 26 in single-sprayed plots and both dates for double-sprayed plots. Plots were 8 rows wide and several hundred feet long. Yields were machine harvested and measured in a weigh wagon. The field was divided into two experiments.

Gross estimates based on an infestation scale from the Philippines were used for measuring aphid abundance. Soybean aphids per plant were rated as follows: 1 = no aphids, 3 = winged aphids to small colony, 5 = several colonies, 7 = many distinct colonies, and 9 = many indistinct colonies. On July 12, aphid colonies were rated as 7 in experiment one and 6 in experiment two. In the untreated checks the colonies increased to ratings of 9 and 7 for experiments one and two, respectively. The insecticides generally knocked the aphids down to a rating of 3 but within two weeks the colonies had increased so that experiments one and two had ratings of 5 and 6, respectively. Aphid populations began to decline naturally around August 16.

There was very little yield difference within either experiment for single applications of any insecticide (Table 5). However, for plots that were sprayed on both dates, the

Warrior-treated strips yielded 5 and 9 bushels more than the dimethoate-treated strips, and 13 and 15 bushels more than the unsprayed checks.

Table 5. Soybean aphid insecticide strip trial, Iowa State University Extension, Decorah, Iowa, 2001.

	Experiment 1 Harvested Oct. 4			Experiment 2 Harvested Sept. 28		
	Date of insecticide application			*Date of insecticide application*		
	July 12	*July 26*	*July 12&26*	*July 12*	*July 26*	*July 12&26*
Treatment	**bushels/acre**			**bushels/acre**		
Dimethoate	28	26	29	40	40	41
Pounce	28	27	32	42	41	50
Warrior	25	25	34	43	41	50
Insecticide average	27	26	32	42	41	47
Check		21			35	

Insecticided strip tests on 8 soybean varieties were conducted by Pat Tekippe, Union Produce Cooperative, Ossian. Warrior at the rate of 3 oz./acre was sprayed on August 4. Differences in yields between sprayed and unsprayed averaged 10.2 bushels with net profit ranging from $16.50-$59.50 per acre (Table 6). There was no estimate provided of the soybean aphid population.

Table 6. Soybean aphid insecticide strip trial, Union Produce Cooperative, Ossian, Iowa, 2001. (Information provided by Pat Tekippe to Brian Lang).

	Bushels/acre[1]		Net profit
Variety	Check	Treated	$/acre
AG 2301	43.1	52.6	32.50
Midwest RT2561	37.3	49.1	44.00
NK S24K4	45.0	51.3	16.50
Croplan 2396	37.2	50.0	49.00
NK S20Z5	38.7	48.4	33.50
Stine 2416-4	35.5	43.8	26.50
Croplan 2241	35.5	50.4	59.50
NK S26H2	39.4	46.6	21.00
Average	39.9	50.1	36.13

[1] moisture at harvest: check=13.3%, treated=13.6%

A summary of insecticide evaluations from the Midwest shows that several insecticides are effective in reducing soybean aphid populations. Additionally, yield protection was achieved at several locations, but in the Iowa locations in 2001 there also were drought conditions during July that influenced the effects of the insect injury on yield losses. However, it must be understood that we are still a very long way from understanding soybean aphid injury, population size, the interactions of good or poor growing conditions, and the effects of these factors on soybean yield. The application of an insecticide is not a guarantee of yield protection or economic gain.

Preventive Tactics

In addition to insecticides, some preventives tactics may help. Eliminating overwintering hosts (buckthorn) would seem to reduce soybean aphid populations but this is impractical for fields near heavily wooded areas where buckthorn may be widespread and abundant. Early planting may allow soybeans to escape or delay aphid population buildup and virus disease. This idea is based on work by Irwin and Schultz (1981) who found highest aphid numbers (not soybean aphid) on the younger plants present in the later plantings. However, early planting also encourages bean leaf beetle colonization, so such should be considered carefully before implementation.

Planting seed of resistant plants may also be an option for future management programs. Currently, there are no commercial soybean cultivars known to be resistant to soybean aphid in the United States.

Prognosis for Iowa

What the pest will do in Iowa next year is unknown. The soybean aphid seems well established in Iowa and has spread westward across the state. It is obvious that the insect can survive very cold weather such as the winter of 2000-2001. The potential exists for economically-damaging aphid populations again in 2002. Fields, particularly in northeastern Iowa, should be scouted when plants reach the V2 and later stages. Population growth should be closely monitored and fields that exceed the early-season threshold may need to be sprayed. Several insecticides are effective in reducing aphid populations by 99%. Fields in mid July that show signs of stunting, blackened leaves from sooty mold, and large aphid populations likewise may benefit from insect control.

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INTRODUCTION TO ISO 9000 & QUALITY MANAGEMENT SYSTEMS WHEN QUALITY COUNTS IN AGRICULTURE.

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Introduction to ISO and Quality Management Systems (QMS)

Rapidly changing consumer expectations related to food safety, environmental protection, animal welfare and managing biotechnology are creating a new marketplace that encourages producers and agribusinesses to differentiate themselves and their products from others. As consumer expectations increase so does the need for a systematic and reliable means of validating consumer confidence that management systems are in place to meet their quality expectations.

ISO certification can provide the platform necessary to differentiate agricultural producers and agri-businesses based on their quality management systems. ISO certification will not be practical for all operations; however, any operation that can benefit through improved quality management needs to give this internationally recognized system consideration regardless of their size or end product. The rewards of obtaining and maintaining ISO certification will vary with each operation. Access to new or existing markets, improved management of resources, or improved customer satisfaction are all reasons for adopting ISO 9000.

ISO 9000 certification: What is it?

ISO 9000 is a quality management system subject to third party verification. It is most simply defined as: ***an operational guide outlining business goals and objects, then thoroughly documenting the procedures implemented to meet those goals and objectives.***

Third party verification of those documents and procedures called *"an audit"* provides the creditability that makes ISO certification internationally recognized and accepted.

ISO is not an acronym, yet it is synonymous with the "International Organization of Standards" based in Geneva Switzerland. This organization is comprised of over 125 nations that have developed voluntary standards used worldwide in industry and manufacturing. Currently there are nearly 300,000 sites registered to ISO standards. ISO through loose Greek translation also means, "equal." In keeping with that skeletal translation ISO 9000 provides a "equal" platform for comparing how businesses establish, document and maintain a creditable quality systems. Through implementation of an ISO program an organization develops <u>its own</u> system of guidance in order to better manage the business. Implementation of this system results in:

- Increased revenue or access to markets by responding to market opportunities.
- Improved utilization of resources and assets
- Strengthened customer loyalty
- Continual improvement of the business

Quality Management Principles

Intertwined throughout all successful ISO quality management systems eight guiding principles will be found.

1. **Customer Focus**
   Understanding current and future needs of customers because the success of the organization is entirely dependent on customer satisfaction.
2. **Leadership**
   Clear direction and purpose should drive every activity and decision within the organization.
3. **Involvement of People**
   Structuring the organization to empower people to best ensure success.
4. **Process Approach**
   Goals and objectives are more easily met when resources are managed as a system.
5. **System approach to management**
   Identifying and managing interrelated processes to achieve organizational effectiveness.
6. **Continual Improvement**
   A permanent goal should be to continually improve the overall performance of the organization.
7. **Factual Approach to decision making**
   Implementing factual analysis of data provides a basis for effective decision-making.
8. **Mutually beneficial supplier relationships**
   Because every organization is dependent on both its customers and its quality suppliers mutually beneficial supply networks must be created.

The Certification Process

The following flow chart outlines the procedures for becoming ISO certified. However, prior to starting the audit process the business entity will need to develop and coordinate the appropriate documentation and procedures. There are four major documentation components:

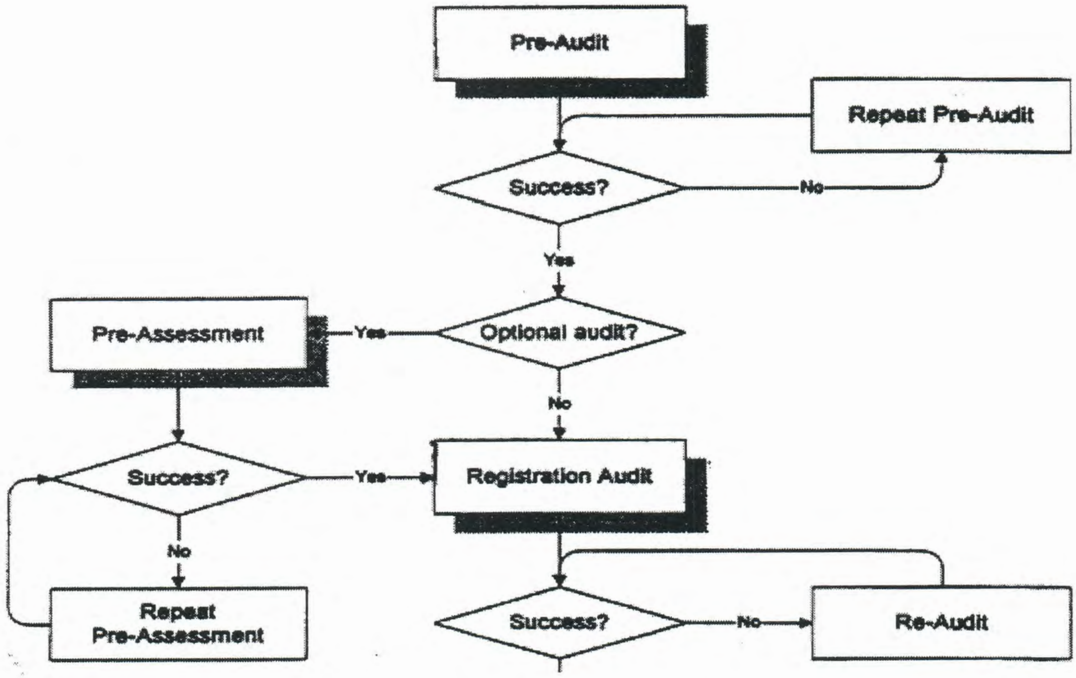
- Quality Manual – provides a description of the enterprise and an overview of the QMS structure.

- Procedure Documents – Instructions for activities that effect quality. Defining who is responsible, when it is performed, where it occurs in the process.

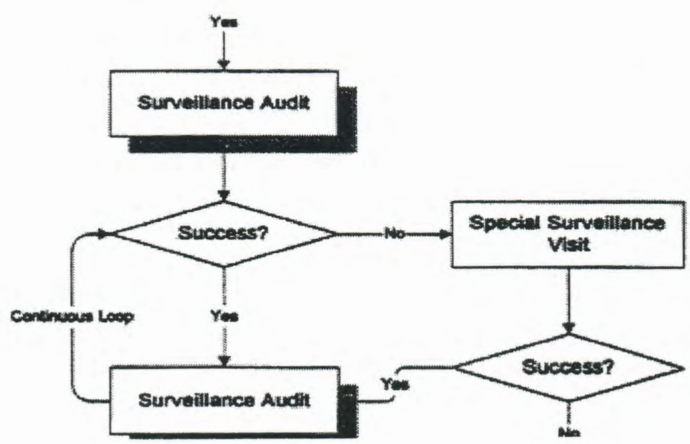
- Working Documents – Specific instruction for each quality related task, and may include blueprints, checklists, flowcharts etc.

- Documentation Controls – Specific regulations on handling records, forms, labels. Orders etc.

ISO Certification Process



CERTIFICATION



Can ISO 9000 successfully be applied to agriculture?

Although standardization and quality management systems have been around since the early 1900's and are widely accepted as the "norm" in business and industry they have never been widely adopted for production agriculture or for any significant portion of the food industry.

The rate at which production agriculture moves away from bulk commodities to differentiated products will dictate the rate at which quality management systems, such as ISO, gain acceptance. During the past decade biotechnology developments, increased organic acreage, and food traceability issues have all demonstrated the need for specialized marketing systems that help maintain product purity and quality control.

Evolving markets such as these repeatedly give us two important lessons.

1. The customer defines acceptable quality.
2. Early adapters to change have the most to gain.

Time and Resources

<u>Initial Certification-</u>

The amount of time and resources needed to reach the point of certification will vary with each individual business operation. Preparatory costs and time commitments are drastically reduced if the operation already utilizes some or all of the major documentation material. Costs can be reduced if portions of the QMS can cooperatively be developed within a farmer's group, guild or similar enterprises. Adequate time for training and implementation with all employees must also be factored into the time and cost equations. Depending on the level of involvement from outside consulting services a conservative time estimate from the time of commitment until certification can be achieved is 12 to 16 months. Because of the number of variables related to scope detailed cost estimates of achieving certification are difficult to estimate but can easily exceed several thousand dollars.

<u>Post Certification-</u>

The actual cost of the third party audits will vary depending on the registrar firm used, but recent inquires indicate that audits will cost $1200-$1500 per day. A farm operation with less than 5 employees would require 2 days of audit time plus travel expenses once initial certification is achieved. Again these costs could be reduced slightly if working with a group or guild of producers.

The commitment to achieve and maintain ISO certification requires a significant allocation of resources. As the industry recognizes that nothing in the marketplace will pay more dividends than customer satisfaction "Quality Management" will increasingly become a very important value-added tool.